

Remarks / Arguments

Prior Art Cited by the Examiner

In the Office Action, the Examiner made reference to 1 document:

Document	Date	Inventor
US-6,188,066	August 1999	Whitehouse et al.,

Claim Rejections – 35 USC § 103

The Examiner objected to claim 1 as previously amended as obvious in view of Whitehouse.

Whitehouse discloses an ion guide. Whitehouse does not disclose an ion trap.

Whitehouse describes a multipole ion guide 40 with a static ring lens 51 at its entrance and with an ion guide exit lens 53 at the exit 52 of the ion guide 40 (column 9: lines 2-50 and particularly 9:40-43). The ion guide exit lens 53 is used to focus ions on the mass analyzer entrance 47. Whitehouse describes a static ring lens 51 at the entrance to the multipole ion guide and also describes static lens elements (not shown) that could be positioned at the exit 52 of the ion guide 40 (9:31-39). Neither the ring lens 51 nor the static lens elements could be used to trap ions in ion guide 40 in the axial or longitudinal direction and Whitehouse does not contain any suggestion that these elements could be used to trap ions in the ion guide 40.

The Examiner referred to Whitehouse at 13:40 to 14:19. The operation of the focusing lens 53 is described in this section. At 13:44-49, Whitehouse states that when the voltage on the focusing lens is ramped, the boundaries of the ion energy for ions of a given m/z, but not a specific charge state can be obtained. Whitehouse illustrates this at 13:61-14:5 and in Figures 8a, 8b and 8c, which illustrate the ion signal levels 100, 101 and 102 when the ion guide DC offset is set at different levels and when the voltage on the ion guide exit lens 53 (mislabeled in Figure 8 as element 51) is ramped.

There is no discussion in this section that the ion guide exit lens 53 could be used for any purpose other than to focus ions that are transmitted through the ion guide 40 on the entrance 47 of the mass analyzer or to identify the boundaries of the ion energy for ions exiting the ion guide 40. Whitehouse does not disclose the use of the ion guide exit lens 53 to trap and release ions having different charge states from the ion guide 40. On the contrary, Whitehouse ramps the voltage on the ion guide exit lens 53 to allow ions of the same m/z to exit the ion trap, depending on their ion energy, but not depending on their charge state.

The Applicant respectfully submits that the ion guide exit lens 53 described by Whitehouse is not an energy barrier as described in claim 1 of the present application. The energy barrier of the present invention has a constant magnitude during a separation time period and presents a first effective barrier height to a first group of ions and a second effective barrier height to a second group ions, wherein the first and second groups of ions have different charge states.

The Applicant respectfully submits that Whitehouse does not describe any ion trap within the meaning of the present invention. At 2:49-52, Whitehouse uses the word "trap" to describe the well known operation of multipole devices to retain ions of a given m/z range based on the RF voltages applied to the poles of the device. However, this operation retains ions in the given m/z range only in the radial direction of the ion guide. It does not relate to the axial direction of the ion guide. Accordingly, the use by Whitehouse of the word "trap" does not refer to an axial or linear ion trap.

The Examiner referred to Whitehouse at 12:19-28 and 12:49-60, where Whitehouse refers to setting the Mathieu values  $a_n$  and  $q_n$  for the ion guide to control the stability region for a range of m/z values. Whitehouse describes the Mathieu values at 9:64 – 10:42. The use by Whitehouse of the word "trapping" at 9:67 again refers to radially retaining ions of a give m/z range in the ion guide. Each of these sections describes controlling the high and low cutoff m/z value, or the m/z range, of ions that will be

transmitted (that is radially trapped or retained) by the ion guide. There is no suggestion that the Mathieu parameters could be selected to provide an axial trapping function, and in fact they cannot be selected to configure an ion guide for that purpose.

The Examiner also referred to Figures 6a and 6b and the related description in Whitehouse. Again, these section refer to the selection of Gramacidin ions based on their m/z values rather than on their charge states.

In his conclusion the Examiner states clearly that he has interpreted from the various sections of the Whitehouse that he cited in the Office Action that Whitehouse varies the energy range of interest and the lens voltage of his ion guide to optimize the transmission of groups of ions having m/z values of interest. The Examiner appears to be equating an ion's m/z value with the ion's charge state. This is incorrect. Ions having the same charge state but different masses will have different m/z values. In Whitehouse's ion guide, ions with a different m/z value will be processed differently by the ion guide (in that ions with different m/z value may be differentially retained or rejected by the ion guide). Such ions will also be processed differently by the ion guide exit lens 52 when the voltage on the exit lens is ramped (in that the different ion energy of ions of the same m/z may be detected at a rudimentary level by ramping the voltage on the ion).

The Examiner states that by controlling the Mathieu parameters and the voltage on the exit lens 52, ions of different m/z may be transmitted or rejected through Whitehouse's ion guide. This is different from the operation of the present invention in which the energy barrier discriminates between ions based on their charge states, not based on the m/z ratios. Again, the Examiner's position appears to be based on equating the m/z value for an ion and its charge state. The Applicant respectfully submits that this assumption is incorrect and that Whitehouse does not render the invention of claim 1 obvious.

The Applicant respectfully submits that the method of claim 1 is inventive over Whitehouse.

Claims 2-24 are dependent on claim 1 and are accordingly patentable over Whitehouse for the same reasons as are set out above.

**Conclusion**

In view of the foregoing comments, it is respectfully submitted that the application is now in condition for allowance. If the Examiner has any further concerns regarding the language of the claims or the applicability of the prior art, the Examiner is respectfully requested to contact the undersigned at 416-957-1630.

Respectfully submitted,



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